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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,346	09/26/2003	Joon-Seo Son	11984.12	9664

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EXAMINER	
IM, JUNGHWA M	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 11/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/672,346	SON ET AL.	
	Examiner	Art Unit	
	Junghwa M. Im	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/31/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Upon further considering the restriction requirement mailed July 14, 2004, the restriction is hereby withdrawn and all claims 1-25 have been examined herein.

Claim Objections

Claims 1 and 6 are objected to because of the following informalities. Claim 1 recites a limitation of "the second surface of the ceramic layer " with an antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11-15 and 19-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 11, 14-15, 19-20 and 25 recite a limitation of "a molding material which encapsulates ... and a portion of the second surface of the ceramic layer." However, Figures of the instant invention does not disclose this aspect. Rather, the instant invention discloses the second surface (the bottom surface) of the ceramic layer is completely exposed. Or if the second surface designates a side surface of the ceramic layer, then a molding material encapsulates entire second surface (the side surfaces) of the ceramic layer.

Claims 12-13 and 21-24 are dependent on the rejected base claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 6-8 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Heinen et al. (US 5422788), hereinafter Heinen.

Regarding claim 6, Fig. 1 of Heinen shows a discrete package comprising:

a lead frame pad [13; a support pad] which has a first surface and a second surface, the second surface which is the opposite surface of the first surface;

leads [21] which are connected to a side of the lead frame pad;

a semiconductor chip [11] which is attached to the first surface of the lead frame pad;

a ceramic layer [a ceramic heat sink; col. 1, lines 31-32] which is attached with the second surface of the lead frame pad via an epoxy [17; col. 2, line 63]; and

a molding material [19] which entirely encapsulates the lead frame pad, the semiconductor chip, and a portion of the ceramic layer, except the leads and the second surface [a bottom surface] of the ceramic layer.

Regarding claim 7 , it is inherent that the leads in Fig. 1 of Heinen are formed to have steps with respect to the lead frame pad. In addition, note that "formed to have steps with " is a

process designation, and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp,* 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 8, Fig. 1 of Heinen shows wires [22] which electrically connect the leads to the semiconductor chip.

Regarding claim 14, insofar as understood, Fig. 1 of Heinen shows a discrete semiconductor package, comprising:

a lead frame [13, 21] having a first surface and a second surface with a lead [21] connected to the lead frame;

a semiconductor chip [11] attached to the first surface of the lead frame;

a ceramic layer [a ceramic heat sink; col. 1, lines 31-32] having a first surface and a second surface, wherein the first surface of the ceramic layer is attached to the second surface of the lead frame via an epoxy [17]; and

a molding material [19] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [side surfaces] of the ceramic layer.

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by Boon et al. (US 6380048), hereinafter Boon.

Regarding claim 1, Fig. 4b of Boon shows a discrete package comprising:

a lead frame pad [64; a die paddle] which has a first surface and a second surface, the second surface which is the opposite surface of the first surface;

leads [65, 68] connected to a side of the lead frame pad;

a semiconductor chip [66] attached to the first surface of the lead frame pad;

a ceramic layer [10; a ceramic substrate; col. 10, line 43] which is positioned to directly contact the second surface of the lead frame pad; and

a molding material [74] which entirely encapsulates the lead frame pad, the semiconductor chip, and a portion of the ceramic layer, except the leads and the second surface [bottom] of the ceramic layer.

Regarding claim 2, Figures. 5a-5c of Boon show the leads are formed to have steps with respect to the lead frame pad. In addition, Note that "formed to have steps with" is a process designation, and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp,* 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 3, Fig. 4b of Boon shows the discrete package further comprising wires [70] which electrically connect the leads to the semiconductor chip.

Regarding claim 5, Fig. 4b of Boon shows the discrete package comprising an adhesive [72; epoxy] between the lead frame pad and the semiconductor chip.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boon in view of Nakanishi et al. (US 6501156), hereinafter Nakanishi.

Regarding claim 4, Fig. 4b of Boon shows substantially the entire claimed structure except "the lead frame pad is formed to a thickness of 0.5 mm." Nakanishi discloses the lead frame pad with a thickness range of 0.5-0.7 mm.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Nakanishi into the device of Boon in order to have to the lead frame pad with a thickness of 0.5 mm to accommodate the manufacturing specification.

In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the lead frame pad with a thickness of 0.5 mm in order to meet the manufacturing specification, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Heinen in view of Nakanishi et al. (US 6501156), hereinafter Nakanishi.

Regarding claim 9, Fig. 1 of Heinen shows substantially the entire claimed structure except "the lead frame pad is formed to a thickness of 0.5 mm." Nakanishi discloses the lead frame pad with a thickness range of 0.5-0.7 mm.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Nakanishi into the device of Heinen in order to have to the lead frame pad with a thickness of 0.5 mm to accommodate the manufacturing specification.

In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the lead frame pad with a thickness of 0.5 mm in order to meet the manufacturing specification, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 10-13 and 15-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heinen in view of Boon.

Regarding claim 10, Fig. 1of Heinen shows substantially the entire claimed structure except that "an adhesive between the lead frame pad and the semiconductor chip." Fig. 4b of Boon shows an adhesive [72] between the lead frame pad [64] and the semiconductor chip [65].

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Boon into the device of Heinen in order to have an adhesive between the lead frame pad and the semiconductor chip to secure the chip to the lead frame pad.

Regarding claim 11, insofar as understood, Fig. 1of Heinen shows a discrete package comprising:

a lead frame [13, 21] having a first surface and a second surface with a lead [21]connected to the lead frame;

a semiconductor chip [11] attached to the first surface of the lead frame;

a ceramic layer [a ceramic heat sink; col. 1, lines 31-32] having a first surface [a top surface] and a second surface [a side surface], wherein the first surface of the ceramic layer is attached to the second surface of the lead frame; and

a molding material [19] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [a side surface] of the ceramic layer.

Fig. 1of Heinen shows substantially the entire claimed structure except "the ceramic layer is directly attached to the second surface of the lead frame." Fig. 4b of Boon shows the ceramic heat sink [10] is directly attached to the lead frame pad [64; a die paddle].

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Boon into the device of Heinen in order to have the ceramic heat sink directly attached to the lead frame pad to reduce the package size.

Regarding claim 12, Fig. 4b of Boon shows the first surface of the ceramic layer does not contain a conductive layer through being a ceramic substrate.

Regarding claim 13, Fig. 1 of Heinen shows a ceramic layer which is attached with the second surface of the lead frame pad by using the molding material [an epoxy 17; col. 2, line 63].

Regarding claim 15, insofar as understood, Fig. 1of Heinen shows an electronic apparatus containing a packaged semiconductor device, the device comprising:

a lead frame [13, 21] having a first surface and a second surface with a lead connected to the lead frame;

a semiconductor chip [11] attached to the first surface of the lead frame;

a ceramic layer having a first surface [a top surface] and a second surface [a side surface], wherein the first surface of the ceramic is attached to the second surface of the lead frame; and

a molding material [19] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [a side surface] of the ceramic layer.

Fig. 1of Heinen shows substantially the entire claimed structure except that "the first surface of the ceramic does not contain a conductive layer." Fig. 4b of Boon shows the first surface of the ceramic [10] does not contain a conductive layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Boon into the device of Heinen in order to have the first surface of the ceramic without a conductive layer to prevent unnecessary noise between the ceramic and the lead frame.

Regarding claim 16, Fig. 4b of Boon shows the first surface of the ceramic layer is directly attached to the second surface of the lead frame.

Regarding claims 17 and 18, Fig. 1 of Heinen shows the ceramic layer is attached to the lead frame by using the molding material [an epoxy] located between ceramic layer and the lead frame.

Regarding claims 19 and 20, insofar as understood, a packaged semiconductor device in Fig. 1of Heinen is made by a method comprising:

providing a lead frame [13, 21] having a first surface and a second surface with a lead connected to the lead frame;

providing a semiconductor chip [11] attached to the first surface of the lead frame;

providing a ceramic layer [heat sink] having a first surface and a second surface, wherein the first surface of the ceramic is attached to the second surface of the lead frame; and

providing a molding material [19] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [a side surface] of the ceramic layer.

The device in Fig. 1of Heinen requires substantially the entire claimed method except a method to provide that "the first surface of the ceramic does not contain a conductive layer." Fig. 4b of Boon shows the first surface of the ceramic [10] does not contain a conductive layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Boon into the device of Heinen in order to have a method to make the first surface of the ceramic without a conductive layer to prevent unnecessary noise between the ceramic and the lead frame.

Regarding claim 21, a device in Fig. 4b of Boon shows a method is required further comprising directly attaching the first surface of the ceramic layer to the second surface of the lead frame.

Regarding claim 22, the device in Fig. 1of Heinen requires the encapsulation is performed using a molding material.

Regarding claims 23 and 24, the device in Fig. 1of Heinen requires further comprising attaching the ceramic layer to the lead frame by using the molding material [17; an epoxy].

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Heinen and Boon in view of Moline (US 5075759).

Regarding claim 25, insofar as understood, a packaged semiconductor device in Fig. 1 of Heinen is made by a method comprising:

providing a lead frame [13, 21] having a first surface and a second surface with a lead connected to the lead frame;

providing a semiconductor chip [11] attached to the first surface of the lead frame;

providing a ceramic layer [heat sink] having a first surface and a second surface, wherein the first surface of the ceramic is attached to the second surface of the lead frame; and

providing a molding material [19] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [a side surface] of the ceramic layer.

The device in Fig. 1of Heinen requires substantially the entire claimed method except a method to provide that "the first surface of the ceramic does not contain a conductive layer." Fig. 4b of Boon shows the first surface of the ceramic [10] does not contain a conductive layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Boon into the device of Heinen in order to have a method to make the first surface of the ceramic without a conductive layer to prevent unnecessary noise between the ceramic and the lead frame.

The combined teachings of Heinen and Boon fails to teach a method providing "an outer heat sink; and connecting the packaged semiconductor device to the outer heat sink." Fig. 3A of

Moline shows a device which requires a method to provide outer heat sink [42] under the ceramic layer [40] and connecting the packaged semiconductor device to the outer heat sink.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Moline into the device of Heinen and Boon in order to have a method to provide an outer heat sink under the ceramic layer to protect the entire package.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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